REMARKS

Receipt of the Office Action of December 10, 2010 is gratefully acknowledged.

Claims 17 and 18 are objected to because of a informality in claim 17. In reply, claim 17 has been amended to remove the informality and thereby obviate the noted objection.

Claims 8, 10 and 18 are rejected under 35 USC 112, first paragraph "as failing to comply with the written description requirement," and under 35 USC 112, second paragraph because the "proprietary protocol" is "neither defined in the claim nor the specification." In reply, claims 10 and 18 has been amended to specifically define the protocol as the RS485 standard. Claim 10, which defined this standard has, therefore been cancelled.

The RS485 standard is a well known standard. See, for example, the Wikipedia discussion submitted as an enclosure hereto. The mere mention of the RS485 standard is, it is respectfully submitted, sufficient disclosure to satisfy the written requirement of 35 USC 112 , first paragraph; and the definiteness requirement of 35 USC 112, second paragraph.

Claims 7, 11 and 13 - 17 are rejected under 35 USC 103(a) over Ketler et al in view of Behrens et al, Mancini et al and Vazach et al.

This rejection is respectfully traversed.

Regarding claim 7, the Examiner alleges that Ketler discloses "transferring the measurement data to a sensor-module head (=unit box 202) and further to a calibration module (=Rem Cal module 509)". Please note, that the Rem Cal

module is a part of the unit box 202 (Fig. 5, ref. 500, col. 6, l. 63-67). Furthermore, it is important to note that in the field monitoring system disclosed by Ketler the sensors are located in a hazardous area, whereas the unit box 202 and necessarily the Rem Cal, too, are located in "fresh air", i.e. a non-hazardous environment (Fig. 2, col. 5, l. 42-47). An intrinsic safety-barrier 502 is arranged within the unit box 500 between the sensors 501 and the Rem Cal Card 509 (cf. Fig. 5 and col. 7, l. 1-5).

The Examiner admits, that Ketler does not disclose "saving the measurement data to a portable storage medium which is separable from the calibration unit, transporting the storage medium in a separated state to the computer unit, connecting the storage medium with the computer unit via an interface that serves as an explosion-barrier providing a galvanic separation". The Examiner alleges that it would have been obvious to the skilled person to modify the system of Ketler to include a portable storage medium as disclosed by Mancini.

However, such a combination would not be reasonable: according to claim 7 the portable storage medium is separable from the calibration unit in order to transport the storage medium in a separated state to the computer unit and to connect it with the computer unit. In the system according to Ketler the calibration unit (the Rem Cal) is already located in a safe area and signals transferred from the sensors 201 to the central computer (Fig. 2) will have already passed the safety barrier within the unit boxes 202, when they will reach the Rem Cal. A similar situation arises for signals transferred in the opposite direction. This means, using a portable storage medium to safely transport data from the calibration unit to the central computer is not necessary, or even useless. For the same reason it would be useless to provide a separable interface as an Explosion barrier according to Vazach for connecting the core medium of Mancini with the central computer of the system disclosed by Ketler.

According to the Examiner the motivation for combining Ketler, Behrens, Mancini and Vazach would have been a circumstance in which the entire industrial controller is contained inside a hazardous area (Behrens, Fig. 2, col. 5, lines 40-46). How can a third document (Behrens) suggest combining Ketler with Mancini? This is particularly questionable, since neither Ketler nor Mancini disclose industrial controllers. The system disclosed by Ketler is an environmental monitor system with sensors distributed within a hazardous area (col. 1, l. 23-29). The information of the distributed sensors should be reported to a control room remote from the sensors and in a safe area (col. 1, l. 34-35 and col. 5, l. 37-38). The whole Ketler reference advises against placing the unit boxes with the Rem Cal cards within the hazardous environment (col. 1, l. 27-65; col. 2, l. 42-44; col. 5, l. 48-53). Hence, a skilled person would not be motivated by Behrens to modify the system according to Ketler using in addition the disclosures of Mancini and Vazach.

For the same reasons, claim 14 is non-obvious in view of Ketler, Behrens, Mancini and Vazach, too.

Regarding claim 8, as already pointed out with respect to claim 7, the intrinsic safety-barrier 502 of the system according to Ketler is arranged within the unit box 500 between the sensors 501 and the Rem Cal Card 509 (cf. Fig. 5 and col. 7, l. 1-5). According to the Examiner, the skilled person would embody the intrinsic safety barrier in such a way as disclosed by Vazach. However, even if this assumption was correct, this combination would still not lead to the feature "transferring the measurement data from the calibration unit to an interface which is embodied as an explosion-barrier providing a galvanic separation (...) and transferring the measurement data from the interface to the computer unit". Instead, the measurement data provided by sensors 501 would be transferred to the intrinsic safety barriers 502 and from these to the Rem Cal card (calibration unit); or to put it bluntly, according to claim 8 the transfer path is "sensor ->

sensor module head -> calibration unit -> Explosion barrier (galvanic separation) -> computer". According to the combination of Ketler and Vazach suggested by the Examiner the transfer path would be "sensor -> sensor module head (= unit box 500) -> Explosion barrier with galvanic separation (intrinsic safety barrier 502 embodied as disclosed in Vazach) -> calibration unit (Rem Cal card) -> computer".

Furthermore, it should be pointed out again that in the Ketler reference the Rem Cal card is part of the unit box 500, hence the feature "transferring the data to a sensor-module head (...) and further to a calibration unit" is not disclosed by Ketler, either.

Regarding claims 11 and 13, the Examiner combines Ketler with Mancini and Behrens and Vazach to reject claim 11. However, for similar reasons as already explained with respect to claim 8 a combination of Ketler with Mancini would be useless and therefore, the skilled person has no motivation to apply the teaching of Mancini to the system of Kettler. The same argument is applicable with respect to claim 13.

Furthermore, Mancini does not disclose the feature "a graphic illustration of the history of the sensor is provided at the computer unit" of claim 13. The Examiner alleges that a graphic illustration is inherent to the anticipated access of data through the user desktop or laptop as a graphic user interface would be required. However, the mere mentioning of a graphic user interface cannot anticipate displaying a graphic illustration of a sensor history. Mancini is completely silent about sensor history data or graphic illustrations. Mancini merely discloses that "data collected" is accessed by the desktop or laptop or any other computer or any other computer operations are performed (col. 3, l. 46-50).

With respect to claim 8 it was pointed out in detail, that Ketler in view of Vazach fails to disclose "transferring calibration data from the calibration unit to an interface, which is embodied as an Explosion-barrier providing a galvanic separation (...); and transferring the calibration data from the interface to the computer unit via a standard interface".

Furthermore, Ketler does not disclose "the computer unit provides a history of the sensor using the calibration data". In col. 1, l. 35-40 cited in the Office Action it is said that relevant parameters such as concentration of a noxious gas, average RPMs etc. are recorded and analyzed. This does not anticipate nor teach nor suggest providing a history of the sensor using calibration data.

The Examiner's "pick-and-choose" approach to the examination of the claims of this application must fail, because it, inevitably, is tied to or guided by applicant's own disclosure. The reason for combining references must be found elsewhere and not in applicant's disclosure.

In view of the foregoing, reconsideration and reexamination are respectfully requested and claims 7, 8 and 10 - 19 found allowable.

Respectfully submitted,
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EIA-485

From Wikipedia, the free encyclopedia

EIA-485, also known as *TIA/EIA-485* or *RS-485,* is a standard defining the electrical characteristics of drivers and receivers for use in balanced digital multipoint systems. The standard is published by the ANSI Telecommunications Industry Association/Electronic Industries Alliance (TIA/EIA). Digital communications networks implementing the EIA-485 standard can be used effectively over long distances and in electrically noisy environments. Multiple receivers may be connected to such a network in a linear, multi-drop configuration. These characteristics make such networks useful in industrial environments and similar applications.

RS-485	
Standard	EIA RS-485
Physical Media	Twisted Pair
Network Topology	Point-to-point, Multi-dropped, Multi-point
Maximum Devices	33 - Including one detatchable terminal (32 drivers and 32 receivers)
Maximum Distance	1200 metres (4000 feet)
Mode of Operation	Differential
Maximum Baud Rate	100 kbit/s - 10 Mbit/s
Voltage Levels	-5 V to +5 V (max)
Mark(1)	Positive Voltages (B-A > +200 mV)
Space(0)	negative voltages (B-A < -200 mV)
Available Signals	Tx+/Rx+, Tx-/Rx- (Half Duplex) Tx+, Tx-, Rx+, Rx- (Full Duplex)
Connector types	Not specified.

Contents

Overview

EIA-485 only specifies electrical characteristics of the driver and the receiver. It does not specify or recommend any communications protocol. EIA-485 enables the configuration of inexpensive local networks and multidrop communications links. It offers high data transmission speeds (35 Mbit/s up to 10 m and 100 kbit/s at 1200 m). Since it uses a differential balanced line over twisted pair (like EIA-422), it can span relatively large distances (up to 4000 feet or just over 1200 meters). A rule of thumb is that the speed in bit/s multiplied by the length in meters should not exceed 10^8. Thus a 50 meter cable should not signal faster than 2 Mbit/s.[1]

In contrast to EIA-422, which has a single driver circuit which cannot be switched off, EIA-485 drivers need to be put in transmit mode explicitly by asserting a signal to the driver. This allows EIA-485 to implement linear topologies using only two wires. The equipment located along a set of EIA-485 wires are interchangeably called nodes, stations and devices. [2]

The recommended arrangement of the wires is as a connected series of point-to-point (multidropped) nodes, a line or bus, not a star, ring, or multiply-connected network. Ideally, the two ends of the cable will have a termination resistor connected across the two wires. Without termination resistors, reflections of fast driver edges can cause multiple data edges that can cause data corruption. Termination resistors also reduce electrical noise sensitivity due to the lower impedance, and bias resistors (see below) are required. The value of each termination resistor should be equal to the cable impedance (typically, 120 ohms for twisted pairs).

Star and ring topologies are not recommended because of signal reflections or excessively low or high termination impedance. But if a star configuration is unavoidable, such as when controlling multiple pan -tilt-zoom video cameras from a central video surveillance hub, special EIA-485 star/hub repeaters are available which bidirectionally listen for data on each span and then retransmit the data onto all other spans.

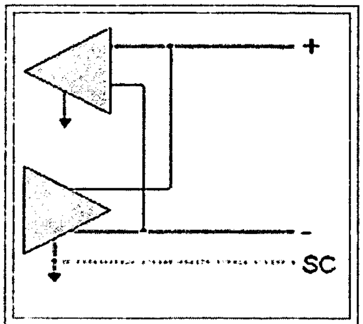
Somewhere along the set of wires, pull up or pull down resistors are established to Fail-safe bias each data line/wire when the lines are not being driven by any device. This way, the lines will be biased to known voltages and nodes will not interpret the noise from undriven lines as actual data; without biasing resistors, the data lines float in such a way that electrical noise sensitivity is greatest when all device stations are silent or unpowered.[3]

Master-slave arrangement

Often in a master-slave arrangement when one device dubbed "the master" initiates all communication activity, the master device itself provides the bias and not the slave devices. In this configuration, the master device is typically centrally located along the set of EIA-485 wires, so it would be two slave devices located at the physical end of the wires that would provide the termination. The master device itself would provide termination if it were located at a physical end of the wires, but that is often a bad design[4] as the master would be better located at a halfway point between the slave devices. Note that it is not a good idea to apply the bias at multiple node locations, because, by doing so, the effective bias resistance is lowered, which could possibly cause a violation of the EIA-485 specification and cause communications to malfunction. By keeping the biasing with the master, slave device design is simplified and this situation is avoided.

Three-wire connection

Even though the data is transmitted over a 2-wire twisted pair bus, all EIA -485 transceivers interpret the voltage levels of the differential signals with respect to a third common voltage. Without this common reference, a set of transceivers may interpret the differential signals incorrectly. In a typical setup, this third voltage is implied in the power supply common/ground connection. However, fundamentally speaking, there is nothing requiring this common voltage to be the same as the power supply. In fact, certain MS/TP (Master Slave / Token Passing) wiring requires full isolation between the various EIA-485 devices and have to run the third wire for the common connection.[5]



RS-485 3 wire connection

Full duplex operation

EIA-485, like EIA-422 can be made full-duplex by using four wires. Since EIA-485 is a multi-point specification, however, this is not necessary in many cases. EIA-485 and EIA-422 can interoperate with certain restrictions.

Converters between EIA-485 and other formats are available to allow a personal computer to communicate with remote devices. By using "Repeaters" and "Multi-Repeaters" very large RS-485 networks can be formed. The Application Guidelines for TIA/EIA-485-A has one diagram called "Star Configuration. Not recommended." Using an RS-485 "Multi-Repeater" can allow for "Star Configurations" with "Home Runs" (or multi-drop) connections similar to Ethernet Hub/Star implementations (with greater distances). Hub/Star systems (with "Multi-Repeaters") allow for very maintainable systems, without violating any of the RS-485 specifications. Repeaters can also be used to extend the distance or number of nodes on a network.

Applications

EIA-485 signals are used in a wide range of computer and automation systems. In a computer system, SCSI-2 and SCSI-3 may use this specification to implement the physical layer for data transmission between a controller and a disk drive. EIA-485 is used for low-speed data communications in commercial aircraft cabins vehicle bus. It requires minimal wiring, and can share the wiring among several seats, reducing weight.

EIA-485 is used as the physical layer underlying many standard and proprietary automation protocols used to implement Industrial Control Systems, including the most common versions of Modbus and Profibus. These are used in programmable logic controllers and on factory floors. Since it is differential, it resists electromagnetic interference from motors and welding equipment.

In theatre and performance venues EIA-485 networks are used to control lighting and other systems using the DMX512 protocol.

EIA-485 is also used in building automation as the simple bus wiring and long cable length is ideal for joining remote devices. It may be used to control video surveillance systems or to interconnect security control panels and devices such as access control card readers.

Although many applications use EIA-485 signal levels, the speed, format, and protocol of the data transmission is not specified by EIA-485. Interoperation even of similar devices from different manufacturers is not assured by compliance with the signal levels alone.

Connectors

EIA-485 does not specify any connector or pinout. Circuits may be terminated on screw terminals, D-subminiature connectors, or other types of connectors.

Signs of common mistakes

From a software engineer's perspective, miswired RS-485 can lead to spurious characters because a spurious mark bit is seen. A bus without good pull up and pull down resistors will be noise-sensitive. These can be system-wide (albeit trivial) problems that require looking beyond just the CPU that is being programmed.

Pin labeling

The EIA-485 differential line consists of two pins:

- **A** aka **'−'** aka **TxD-/RxD-** aka **inverting** pin
- **B** aka **'+'** aka **TxD+/RxD+** aka **non-inverting** pin
- **SC** aka **G** aka **reference** pin

The SC line is the optional voltage reference connection. This is the reference potential used by the transceiver to measure the A and B voltages.

The B line is positive (compared to A) when the line is idle (i.e., data is 1).

In addition to the **A** and **B** connections, the EIA standard also specifies a third interconnection point called **C**, which is the common signal reference ground.

These names are all in use on various equipment, but the actual standard released by EIA only uses the names **A** and **B**. However, despite the unambiguous standard, there is much confusion about which is which:

The EIA-485 signaling specification states that signal **A** is the **inverting** or '-' pin and signal **B** is the **non-inverting** or '+' pin.[6]

This is in conflict with the A/B naming used by a number of differential transceiver manufacturers, including, among others:

- Texas Instruments, as seen in their application handbook on EIA-422/485 communications (A=non-inverting, B=inverting)
- Intersil, as seen in their data sheet for the ISL4489 transceiver[7]
- Maxim, as seen in their data sheet for the MAX483 transceiver[8]

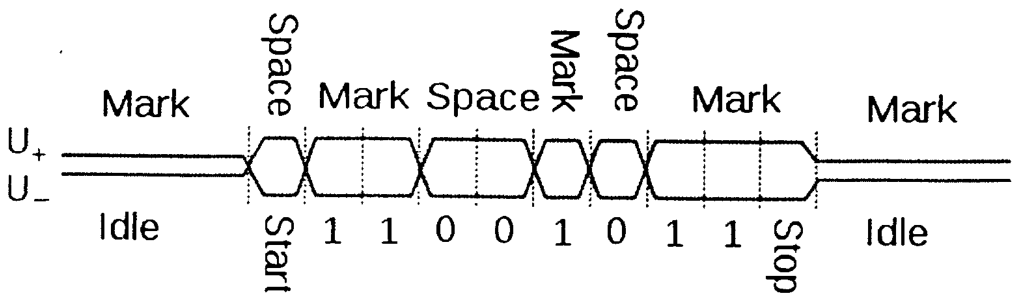
These manufacturers are incorrect, but their practice is in widespread use.

Therefore, care must be taken when using A/B naming.

The standard does not discuss cable shielding, but makes some recommendations on preferred methods of interconnecting the signal reference common and equipment case grounds.

Waveform example

The graph below shows potentials of the '+' and '–' pins of an EIA-485 line during transmission of one byte (0xD3, least significant bit first) of data using an asynchronous start-stop method.



See also

- Electronic Industries Alliance
- RS-232
- RS-422
- RS-423
- Profibus
- Fieldbus
- List of network buses

References

1. ^ ti.com - Texas Instruments, Application Report, SLLA070D–June 2002–Revised May 2010, RS-422 and RS-485 Standards Overview and System Configurations (http://focus.ti.com/lit/an/slla070d/slla070d.pdf) May 2010
2. ^ Engineering Department, Electronic Industries Association, *EIA Standard RS-485 Electrical Characteristics of Generators and Receivers for Use in Balanced Multipoint Systems*, reprinted in Telebyte Technology "Data Communication Library" Greenlawn NY, 1985, no ISBN, no Library of Congress card number
3. ^ http://www.national.com/an/AN/AN-847.pdf
4. ^ http://www.ccontrols.com.cn/pdf/Extv9n2.pdf
5. ^ http://www.chipkin.com/articles/rs485-cables-why-you-need-3-wires-for-2-two-wire-rs485
6. ^ http://www.bb-europe.com/tech_articles/polarities_for_differential_pair_signals.asp
7. ^ http://www.intersil.com/data/fn/fn6074.pdf
8. ^ http://datasheets.maxim-ic.com/en/ds/MAX1487-MAX491.pdf

External links

- Guidelines for Proper Wiring of an RS-485 (TIA/EIA-485-A) Network (http://www.maxim-ic.com/app-notes/index.mvp/id/763)
- Technical library of RS-485 articles and application notes (http://www.bb-elec.com/technical_library.asp)
- RS232 to RS485 cable scheme (http://pinouts.ru/SerialPortsCables/rs485_cable_pinout.shtml)
- Practical information about implementing RS485 (http://www.lammertbies.nl/comm/info/RS-485.html)

- Implementation of RS485 standard in the Linux OS (http://retis.sssup.it/~scordino/code/rs485.html)

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